Attention: This is the draft version.

The final version of the "Clean Technology and Renewable Energy Partnership Academy Guidelines" can be found here: http://www.energy.ca.gov/cleanenergyacademies/documents/

California Energy Commission

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STAFF REPORT

DRAFT

CLEAN ENERGY PARTNERSHIP ACADEMY GUIDELINES

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CALIFORNIA ENERGY COMMISSION

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ABSTRACT

The California Energy Commission is developing guidelines for the Clean Energy Partnership Academies as required by the Clean Technology and Renewable Energy Job Training, Career Technical Education, and Dropout Prevention Program. This program was created by Senate Bill X1 1 (Steinberg, Chapter 2, Statutes of 2011). The partnership academies will prepare high school students in grades 9-12 for the high-wage jobs created by California's advancement of renewable energy, energy and water efficiency and conservation, integrated water management, clean technology, climate change, and energy security policies.

California, Partnership Academies, efficiency, renewable, conservation, clean energy, education, workforce, career, training, high school

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CHAPTER I:
Introduction

The California Energy Commission is adopting the Clean Energy Partnership Academies Guidelines in consultation with the Superintendent of Public Instruction (SPI) and in compliance with Senate Bill X 1 1, (Steinberg, Chapter 2, Statutes of 2011). This legislation established the Clean Technology and Renewable Energy Job Training, Career Technical Education, and Dropout Prevention Program, the goal of which is to link students in grades 9-12 with the career opportunities created by California's advancement of renewable energy, energy and water efficiency and conservation, integrated water management, clean technology, climate change, and energy security policies.

These guidelines provide a roadmap to prospective Clean Energy Partnership Academies to help them provide instruction and resources to students that meet the goals outlined in the legislation. The Clean Energy Partnership Academies offer an exceptional opportunity to students at risk of dropping out of school to explore career opportunities and prepare for new jobs and newly retooled jobs created by the clean energy economy. The academies will build a career pipeline for clean energy and related industries in California while the students that graduate from the academies will become the talent pool for this growing clean energy economy.

The Energy Commission welcomes the opportunity to partner with the Department of Education (CDE), which administers the academies, to provide this guidance for these new academies. California's investment in building a highly trained clean energy workforce is essential to ensuring California's economic strategy and competitiveness in these industries.

Background

CDE established the partnership academies in 1983. An academy is a multiyear program for high school students structured as a school within a school. Partnership academies combine career technical education with academic courses to prepare students for graduation, future employment, and post-secondary education. At least 50 percent of the students entering an academy must meet specific "at-risk" criteria, which include low GPA, low test scores, and irregular attendance. Curriculum focuses on a career theme, such as health, energy, or information technology, and is coordinated with related academic courses. The career technical focus for an academy is determined by an analysis of the local labor market and fields that have companies willing to support the program. According to the CDE, there are more than 500 academies currently operating in the state preparing students for a wide variety of careers. For more information on the academies, including a directory of current academies, go to http://www.cde.ca.gov/ci/gs/hs/cpagen.asp.

Legislative Authority for the Guidelines

SBX 1 1 requires the Energy Commission to adopt guidelines to ensure that the Clean Energy Partnership Academies reflect the state's policies and priorities and industry needs. The pertinent language from the *Education Code* is as follows:

> Section 54699 (e)(1) No later than 60 days after the effective date of this article, and prior to the department issuing a request for grant applications, the State Energy Resources Conservation and Development Commission, in consultation with the Superintendent, shall adopt guidelines to ensure that programs receiving grants reflect current state energy policies and priorities as well as provide skills and education linked to the needs of relevant industries.

Energy Commission Responsibilities

The California Energy Commission will advise CDE to ensure academy programs receiving grant funding under this legislation align with current energy policies and priorities and provide skills and education linked to the needs of the clean energy industries. As part of its obligations under SBX1 1, the Energy Commission will advise CDE on: 1) the release of grant solicitations for prospective academies; 2) review of applications; and 3) identifying and analyzing gaps in the program, recommending improvements reviewing programs to ensure they focus on employment in clean technology businesses or renewable energy businesses, providing skilled workforces, and meeting other requirements as stated in SB 1 1; and 4) preparing an annual report to the Legislature. In addition, in consultation with CDE, the Energy Commission will update these guidelines as needed to address changes in the program or the law.

CHAPTER II: Guidelines

Definition of "Clean Energy Partnership Academy"

A Clean Energy Partnership Academy meets the general requirements for a California Partnership Academy under *Education Code* 54690- 54697 and promotes the development of career technical education (CTE). The CTE component of the academies delivers the skills and knowledge needed for future successful employment in sectors aligning with state policy goals as outlined in SB X1 1. Specifically, approved school districts will "implement a partnership academy, or…maintain an existing academy, that focuses on employment in clean technology businesses or renewable energy businesses and provides skilled workforces for the products and services for energy or water conservation, or both, renewable energy, pollution reduction,

or other technologies that improve the environment in furtherance of state environmental laws."

Academy Selection Criteria

The clean energy partnership academies will be selected by CDE, in consultation with the Energy Commission, through a competitive process consistent with *Education Code* 54690-54697 and in consideration of their ability to meet the goals of these guidelines.

Goals for the Clean Energy Partnership Academies

The Clean Energy Partnership Academies should strive to meet the goals outlined below to ensure that students are adequately prepared for further education and training and entrance into the clean energy workforce.

- Align programs with California's policies for a clean energy future and understand how these policies shape the partnership academy programs.

  California has established its place as a world leader in energy and water efficiency, integrated water management, renewable energy and environmental and air quality policies. These policies create an infrastructure for clean energy in the state. The academies should introduce general concepts and technologies that are the basis for these policies (for example, energy efficiency, loading order, demand response, smart grid, renewable portfolio standards, and cap and trade). This background knowledge will enable the students to understand the state's goals in these targeted areas and to become part of the workforce capable of meeting the goals established for the clean energy economy.

  It is important that the academies select a policy focus on which to concentrate. For example, an academy may choose to focus on renewable fuel sources, modes of mass transportation, tap-to-toilet water recycling, integrated water management, or zero net energy building. To ensure that academies stay on track with statewide strategies, programs should not concentrate on technologies that are not addressed in current state policies. The following section, "State Energy and Environmental Policies and Priorities," summarizes the policies that will guide the programs.

- Provide students with the knowledge and skills to enter industry-recognized, specialized, and high-quality training that will lead to a sustainable, high-wage career.

  Clean Energy Partnership Academies should provide a solid foundation for students in principles of energy efficiency, water efficiency, renewable energy, pollution prevention, and related technologies. Topics addressed should include basic energy and environmental science as well as specialized instruction in the area of focus. Preparing students with strong foundational knowledge will position them to enter specialized training and education programs and obtain

industry-recognized certifications. According to a 2011 report by the Corps Network titled *A Green Career Pathways Framework*, "green" skills increase earning potential by 13 percent for a position requiring just a high school diploma and up to 60 percent for an occupation requiring a four-year degree.

Much of the training and education provided in these academies may not result in a specific "green" specialty occupation, but this preparation is essential to building competency in clean-energy-related practices and technologies as well as the soft skills (for example, professionalism, communication skills, teamwork and collaborative skills, critical thinking, and problem-solving) required in traditional occupations, such the construction trades, engineering, and architecture. This training may further enable academy graduates to foster sustainable approaches in general business practices.

- Promote the development and use of clean energy career technical education training that adapts and responds to emerging technologies and workplace needs.

  A 2009 report by the President's Council of Economic Advisers projects that the global market for renewable energy generation and energy efficiency, recycling and waste management, water supply, and other resource management will double by 2020. While occupations in these areas require training in new and emerging technologies, many of the skills required are grounded in the traditional trades, such as electrical work, construction, and plumbing.

  The clean energy partnership academies should provide the basis for training that bridges traditional instruction with skills required by these new and emerging technologies that form the core of the clean energy economy. By integrating these technologies into the standard curriculum, the academies can improve the students' readiness to enter post secondary training.

- Develop and sustain partnerships with community and labor organizations, local workforce investment boards, businesses, and post secondary educational institutions to connect to emerging labor trends in the clean energy economy.

  The Clean Energy Partnership Academies have a valuable opportunity to tap into an existing infrastructure of resources developed through the Clean Energy Workforce Training Program, the California community colleges, local workforce investment boards, labor and community organizations and universities. Forming partnerships with these entities will enable the academies to set academic and technical standards that prepare students for both college and career; articulate their programs with pre apprenticeships and other standardized, industry-recognized education and training; use training resources, including curricula, equipment, facilities, mentors, and instructors; guide students in selecting and preparing for college admissions or further training; and create a viable career pipeline for students choosing clean energy careers. The academies should also strive to work with pre apprenticeship programs and post secondary institutions to advance a series of stackable credentials that will enable students to move up the clean energy career ladder.

In addition, the academies should partner with regional industry cluster planning that aligns workforce development with local economic development strategies to ensure the career technical education components provide content relevant to the local clean energy economy.

- Prepare students to be leaders and advocates in their schools and communities on clean energy and environmental issues facing California.

  A fundamental aspect of energy and water use is the impact on the environment. While the primary focus of the Clean Energy Partnership Academies is to allow students to explore clean energy occupations and prepare them for future careers in this sector, academies bear responsibility for teaching students about the role and impact of energy and water on the environment as well as on society and the economy. The academies should encourage students to take personal responsibility for the use of these resources in their own lives and to serve as role models for their schools and communities. In appropriate courses, the curriculum should substantially align to California's Approved Environmental Principles and Concepts to promote environmental understanding.

  In addition, by using school facilities as living learning labs, the students can apply their knowledge directly in the school setting. For example, the Schools of the Future program, which allows schools to increase energy efficiency, provides an excellent opportunity for students to learn from the retrofit process in their schools and to foster cultural changes regarding energy and water among their peers and other members of the school community related to this program.

State Energy and Environmental Education Policies and Priorities

California has adopted ambitious energy and environmental policy goals, including reducing statewide greenhouse gas (GHG) emissions and reliance on fossil fuels. The foundations of these goals are reflected in the state's "loading order," which calls for the optimal management of energy resources through increasing energy efficiency, improving demand response to reduce energy use during peak times, and increasing renewable energy sources and distributed generation of electricity. In addition, state policies call for reducing consumption of or enhancing the recycling of water through improved conservation and management methods and consumption practices. These principles should form the foundation of any focus an academy selects for its program.

It is essential that the academies use these policies to shape their programs. The following documents contain essential information on policies governing energy, water, pollution, and related areas. These documents will guide academies in selecting curricula and in providing career guidance to students. A short summary of each document is provided along with primary focus areas.

California's Clean Energy Future

http://www.cacleanenergyfuture.org/

Achieving the state's clean energy goals for electricity and natural gas requires coordinated actions of the California Energy Commission, Public Utilities Commission, Air Resources Board, Independent System Operator, and Environmental Protection Agency. The California Clean Energy Future initiative highlights coordination of strategies to achieve the state's aggressive goals for a timely and smooth transition to a clean energy economy.

Possible academy focus:

- California electricity demand (see http://www.caiso.com) and renewable energy goals.
- State agency clean energy policy interdependency.
- Electricity and clean energy infrastructure, including smart grid technology to increase the efficiency of electrical power distribution.
- Wholesale power market: operational, technological, and infrastructure needs analysis; program design, long-term planning, and procurement functions; research and development activities.

California Energy Action Plan

http://www.energy.ca.gov/2008publications/CEC-100-2008-001/CEC-100-2008-001.PDF

The California Public Utilities Commission and the Energy Commission originally adopted the *California Energy Action Plan* in 2003 in response to the energy crisis facing California. An update was published in 2005, and another in 2008. The goal of the *Energy Action Plan* is to unify California energy policy goals and to determine how to best meet California's electricity and natural gas needs. This plan addresses the state's loading order, which requires that the state invest first in energy efficiency and demand-side resources, followed by renewable resources, and only then in clean conventional electricity supplies.

Possible academy focus:

- Natural gas supply and infrastructure in the California energy market.
- Electricity reliability, infrastructure, and market structure.
- Demand response and how it relates to the reduction of greenhouse gas emissions.

Global Warming Solutions Act of 2006 (AB 32)

http://www.arb.ca.gov/cc/ab32/ab32.htm

Assembly Bill 32 established the State's goal of reducing GHG emissions. Consumption of fossil fuels (oil, natural gas, and coal) is the largest source of California's GHG emissions. The California Air Resources Board (ARB) is the lead State agency in implementing this law, in close coordination with the State's energy and natural resource agencies.

Possible academy focus:

- Technologically feasible and cost-effective methods for GHG emission reduction.
- Regulations, market mechanisms, and policy related to GHG emission reduction.
- Zero/reduced-emission vehicles and alternative fuels (see http://www.arb.ca.gov/msprog/clean_cars/clean_cars.htm).

California Energy Efficiency Strategic Plan

http://www.cpuc.ca.gov/NR/rdonlyres/A54B59C2-D571-440D-9477-3363726F573A/0/CAEnergyEfficiencyStrategicPlan_Jan2011.pdf

The California Energy Efficiency Strategic Plan was adopted to provide long-term planning that facilitates California's achievement of ambitious energy efficiency and GHG reduction goals. The plan describes an integrated approach to realizing zero net energy buildings through energy efficiency, distributed generation, and demand response measures.

Possible academy focus:

- Renewable Residential, commercial, industrial, and/or agricultural energy efficiency, including low-income housing, especially as it pertains to California's loading order.
- Energy-efficient heating, ventilation, and air-conditioning.
- Energy-efficient lighting practices.
- Research and "development, enhancement, deployment, and operation of more and better energy efficiency-related technology."

Renewable-Portfolio Standard

http://www.cpuc.ca.gov/PUC/energy/Renewables/

The Renewables Portfolio Standard (RPS) requires electricity providers to increase procurement from eligible renewable energy resources by at least 1 percent of their retail sales annually, until they reach 33 percent by 2020.

Possible academy focus:

- Marketing and financing of eligible renewable technologies.
- Renewable technology installation and maintenance.
- Renewable energy tariffs and other economic policies.

Sustainable Communities and Climate Protection Act of 2008 (SB 375)

http://www.arb.ca.gov/cc/sb375/sb375.htm

Senate Bill 375 calls for the integration of land use planning, housing planning, and transportation planning. The goal of such integration is to reduce California's dependence on automobiles and achieve the associated GHG emission reductions, reduced dependence on petroleum, and public health benefits of improved air quality, less traffic, and fewer accidents. A wide range of skills will be needed to develop "Sustainable Community Strategies" and integrate the local government planning functions that affect vehicle miles traveled.

Possible academy focus:

- Urban planning.
- Alternative-fuel vehicles and infrastructure.
- Renewable energy and fuels.
- Water efficiency and wastewater treatment.
- Energy storage.

Bioenergy Action Plan

http://www.energy.ca.gov/bioenergy_action_plan/

Executive Order S-06-06 established targets to increase the production and use of bioenergy, including ethanol and biodiesel fuels from renewable resources. For biofuels, the state's goal is to produce a minimum of 40 percent of its biofuels within California by 2020 and 75 percent by 2050.

Possible academy focus:

- Bioenergy and biofuel theory and production.
- Cost reduction for biomass conversion, biopower technologies, and environmental controls.
- Collecting biomass products using sustainable practices.
- GHG emission reduction associated with bioenergy and biofuels.

Renewable Fuel Standard

http://www.epa.gov/otaq/fuels/renewablefuels/

The federal Renewable Fuel Standard Program requires that 36 billion gallons of total renewable fuel be used as transportation fuel by 2022. The transportation sector will employ low-carbon fuel and vehicle technologies including battery and fuel cell electric vehicles, low-carbon biofuels, improved vehicle efficiency, and natural gas and propane vehicles.

Possible academy focus:

- Renewable fuel content in gasoline and diesel/gasoline and diesel composition.
- Transportation fuel usage in California/United States.
- Greenhouse gas life cycle as it relates to fuel usage, production, disposal, and so forth.
- Alternative-fuel vehicles and infrastructure.

Low Carbon Fuel Standard (LCFS)

http://www.arb.ca.gov/fuels/lcfs/lcfs.htm

This standard establishes carbon intensity standards that fuel producers and importers must meet each year beginning in 2011, to reach a 10 percent carbon intensity reduction by 2020. Promoting plug-in electric vehicles and fuel cell vehicles coupled with a cleaner energy supply will maintain a reliable, efficient, and affordable energy system that minimizes environmental impacts. The key points of this standard are: reduce energy demand and greenhouse gases, develop a broader range of alternative energy resources, improve energy infrastructure, and continue to develop and, adopt the "clean energy" technologies that are critical for long-term reliability and economic growth."[1]

Possible academy focus:

- Alternative-fuel vehicles and infrastructure.
- Renewable energy and fuels.

Comprehensive Energy Efficiency Program for Existing Residential and Nonresidential Buildings (AB 758)

- Zero Net Energy Buildings
  http://docs.cpuc.ca.gov/PUBLISHED/NEWS_RELEASE/122911.htm

[1] California Energy Commission, 2009 Integrated Energy Policy Report, Final Commission Report, December 2009, CEC-100-2009-003-CMF

In September 2010, the California Public Utilities Commission (CPUC) joined California business leaders to launch a 2010-2012 Zero Net Energy Action Plan designed to help California commercial building owners take advantage of the latest technologies and financial incentives to help reduce building energy use to `net-zero' through greater efficiency and on-site clean energy production.

Zero net energy (ZNE) buildings have a net energy consumption of zero over a typical year. On-site solar, wind, and other renewable energy resources generate the amount of energy used by the building. To date, California has more ZNE buildings than any other state in the nation. Technologies needed to achieve ZNE-including high performance lighting and distributed generation such as rooftop solar-are widely available and incentivized.

- The California Solar Initiative
  http://www.gosolarcalifornia.org/about/gosolar/legislation.php

  In 2006, Senate Bill 1 established the California Solar Initiative. It required the Energy Commission and the California Public Utilities Commission to implement a program aimed at installing 3,000 megawatts of solar energy systems on new and existing residential and commercial sites and placing solar energy systems on 50 percent of new homes by 2020.

- Assembly Bill 758
  http://www.energy.ca.gov/ab758/

  In 2009, Assembly Bill 758, was established and requires the California Energy Commission to develop and implement a comprehensive program to achieve greater energy savings in existing residential and nonresidential building stock, including energy assessments, cost-effective energy efficiency improvements, financing options, public outreach, and education efforts.

- Implementing California's Loading Order for Energy Resources

Possible academy focus:

- Residential, commercial, industrial, and/or agricultural energy efficiency, including low-income housing, especially as it pertains to California's loading order.
- Energy-efficient heating, ventilation, and air conditioning.
- Energy-efficient lighting practices.
- Research and "development, enhancement, deployment, and operation of more and better energy-efficiency related technology."
- Marketing and financing of eligible renewable technologies.
- Renewable technology installation and maintenance.

Education and the Environment Initiative

http://www.calepa.ca.gov/Education/EEI/

The California Environmental Protection Agency's Education and the Environment Initiative seeks to promote environmental literacy by introducing environmentally focused science, economy, and technology curriculum into classrooms. EEI curriculum unit teaches a specific subject using California Environmental Principles and Concepts.

Coursework Progression

The partnership academies follow a standard model of coursework progression, as indicated below. Coursework for the 9th grade is included as this legislation includes this grade in the Clean Energy Partnership Academies.

- 9th Grade – Explore/Set Foundation: Introduction to Energy and Career Options
- 10th Grade – Prepare: Industry Knowledge/Workforce Skills and Knowledge
- 11th Grade – Prepare: Workforce Skills and Knowledge
    - Students are matched with mentors from relevant industries.
- 12th Grade – Prepare: Workforce Skills and Knowledge
    - Experience: Internships
    - Preparation for postsecondary pursuits
- Grades 9-12 – Curricular Integration: Academic and Career Connections, Interdisciplinary Projects
- Other activities: speakers; field trips; career-related events and competitions; social, fundraising, and other events to promote leadership skills development; community service; recognition; team building; parent participation; tutoring; and mentoring.

Alignment With Career Technical Education Standards

The following career technical education industry sectors and example course sequences listed below are most directly aligned with the intent of the legislation and will help to guide academies in sector and course selection. With appropriate justification, academies may select another sector on which to concentrate the program of study. This information also appears in Appendix 5 of the Clean Energy Partnership Academy Request for Applications (RFA) issued XXXXXX.

- **Energy and Utilities** include, but are not limited to:
    - Energy audits subsidized by utility and state programs or audits that lead to energy savings incentivized by utility and state programs or that develop the pathway to net zero energy.

- Energy technologies or practices and renewable energy production relating to energy distribution, storage, infrastructure, and transmission; clean heat and power; and water and wastewater (including water conservation).
- Energy efficiency technologies and practices that relate to California's energy loading order and are directed at achieving the State's Strategic Energy Plan Goals for 2020 and 2030. Some examples include advanced lighting, heating and cooling, demand response, home automation networks, and smart appliances.
- Renewable energy businesses relating to research and development; manufacturing; generation; development; maintenance; power storage; energy production; installation, repair, and maintenance of wind, photovoltaic, solar thermal, geothermal, and biomass**.**
- Examples of CTE Sequence of Courses:
    - Renewable Energy: Resource: National Center for Construction Education and Research (NCCER) http://nccer.pearsonconstructionbooks.com/index.aspx
        1) Introductory Craft Skills (Core Curriculum) and Introduction to the Power Industry (Grade 9)
        2) Power Industry Fundamentals (Grade 10)
        3) Alternative Energy (Grade 11)
        4) Specialization: (Grade 12)
            - Introduction to Solar Photovoltaics and Solar Thermal Energy
            - Introduction to Wind Energy
            - Introduction to Biofuels
            - Introduction to Geothermal Energy
    - Energy Generation Technician: Resource: Florida Department of Education: http://www.fldoe.org/workforce/dwdframe/energy_cluster_frame10.asp
        - Energy Foundations (Grade 9)
        - Introduction to Alternative Energy (Grade 10)
        - Energy Generation Technician I (Grade 11)
        - Energy Generation Technician II (articulate with post-secondary) (Grade 12)

- **Building Trades and Construction** include, but are not limited to:
    - Retrofitting and weatherization that increase energy efficiency and conservation.
    - Energy and water efficient public buildings.
    - Retrofitting and installing energy-efficient household appliances, windows, doors, insulation, and lighting.

- Retrofitting and installing energy-efficient heating and cooling systems, including geothermal heat pumps, programmable thermostats, for homes, and commercial and public buildings.
- Installation of home electric vehicle charging systems.
- Designing and installing solar PV and solar thermal systems.
- Retrofitting and installing water and energy conserving technologies, including the use of energy and water management technologies and control systems, including home automation networks and building automation systems, in existing homes, multifamily housing, industrial, commercial, and public buildings.
- Examples of CTE Sequence of Courses:
    - Solar Energy Technician: Resource: Florida Department of Education: http://www.fldoe.org/workforce/dwdframe/energy_cluster_frame10.asp
        1) Energy Foundations (Grade 9)
        2) Introduction to Alternative Energy (Grade 10)
        3) Solar Energy Technician I (Grade 11)
        4) Solar Energy Technician II (Grade 12)
    - Green Construction: Resource: FourEnergy, the Advanced Transportation, Technology and Energy Initiative: http://www.fourenergy.org/greenacademies/html/curriculum.html
        1) Introduction to Energy (Grade 9)
        2) Green Construction (Grades10 and 11)
        3) Energy Auditing (Grade 12)

- **Engineering** includes, but is not limited to:
    - Introduction to energy auditing, including understanding whole building design, (for example, Building Information Systems [BIM] modeling), the role of the engineer, and how to develop energy conservation measures.
    - Energy-efficient technologies or practices and renewable energy production, including energy distribution, storage, infrastructure, and transmission, clean heat and power, and water and wastewater (including water conservation).
    - Concepts and practices of Net Zero Energy Buildings, including plan development, benchmarking, retrocommissioning, and continuous commissioning.
    - Examples of CTE Sequence of Course**s**:
        - Environmental & Natural Science Engineering: *Resource: State Center Consortium:* http://www.statecenter.com/sites/statecenter.com/files/pos/Environmental%20Engineering-Horticulture.doc

1) Engineering Technology (Grade 9)
2) Exploring Engineering and Design, Level 1 (Grade 10)
3) Exploring Engineering and Design, Level 2 (Grade 11)
4) Environmental & Natural Science Engineering (Grade 12)

- Environmental Engineering: Resource: Project Lead the Way: http://www.pltw.org/our-programs/engineering-curriculum
  1) Energy and the Environment (Grade 9)
  2) Introduction to Engineering Design (IED) (Grade 10)
  3) Principles of Engineering (POE) (Grade 11)
  4) Engineering Design and Development (EDD) (Grade 12)

- **Manufacturing and Product Development** include, but are not limited to:
  - Manufacture, sale, assembly, installation, construction, and maintenance of energy efficient and renewable technologies.
  - Examples of CTE Sequence of Courses:
    - Computer Integrated Manufacturing: *Resource: Project Lead the Way:* http://www.pltw.org/our-programs/engineering-curriculum
      1) Energy and the Environment (Grade 9)
      2) Introduction to Engineering Design (IED) (Grade 10)
      3) Computer Integrated Manufacturing (CIM) (Grade 11)
      4) Engineering Design and Development (EDD) (Grade 12)
    - Energy Efficiency in Manufacturing: Materials and Processes Technology
      1) Materials and Processes Technology I (Grade 9): *Resource: Florida Department of Education:* http://www.fldoe.org/workforce/dwdframe/1112/stem/rtf/8601100.rtf
      2) Materials and Processes Technology II (Grade 10): *Resource: Florida Department of Education:* http://www.fldoe.org/workforce/dwdframe/1112/stem/rtf/8601100.rtf
      3) Materials and Processes Technology III (Grade 11): *Resource: Florida Department of Education:* http://www.fldoe.org/workforce/dwdframe/1112/stem/rtf/8601100.rtf
      4) Choice of specialization course in manufacture, sale, assembly, installation, construction, and/or maintenance of energy efficient and renewable technologies (Grade 12).

    Other Resources

- PowerPoint® from Kansas State University on "Bringing Awareness on Sustainable Green Manufacturing to Students" http://krex.k-state.edu/dspace/bitstream/2097/1293/1/RD-Sustainable%20Manufacturing-1130.pdf
- Purdue University Green Manufacturing Website: http://www.greenmanufacturing.purdue.edu/

- **Agriculture and Natural Resources** include, but are not limited to:
  - Retrofitting and installing water and energy conservation technologies and techniques to improve efficiency, including the use of energy and water management technologies and control systems in farms, forests, and ranches.
  - Natural resource conservation for the purpose of adapting to climate change, including fish and wildlife habitat restoration, reforestation, native species preservation, invasive species eradication, community tree planting, and other activities that address the stressors on natural resources generated by climate change.
  - Examples of CTE Sequence of Courses:
    - Forestry and Natural Resources: *Resource: State Center Consortium:* http://www.statecenter.com/sites/statecenter.com/files/pos/Forestry%20and%20NR.doc
      1) Environmental Science (Grade 9)
      2) Forestry and Natural Resources (Grade 10)
      3) Environmental Conservation (Grade 11)
      4) Field Surveying (Grade 12)
    - Natural Resource Conservation:
      1) Natural Resource Conservation: Management for a Sustainable Future (Grade 9): Resource: Pearson Higher Ed: http://www.pearsonhighered.com/educator/product/Natural-Resource-Conservation-Management-for-a-Sustainable-Future/9780132251389.page
      2) Specialization Courses (Grades 10 and 11):
         a. Ocean Environmental Management:
            i. Introductory Oceanography: Resource: Pearson Higher Ed: http://www.pearsonhighered.com/educator/product/Introductory-Oceanography/9780131438880.page
            ii. Ocean Environmental Management: A Primer on the Role of the Oceans and How to Maintain Their Contributions to Life On Earth: *Resource: Pearson Higher Ed:*

http://www.pearsonhighered.com/educator/product/Ocean-Environmental-Management-Primer-Role-Oceans-and-How-Maintain-Their-Contributions-Life-Earth/9780131845572.page

b. Hydrology/Water Systems

i. Applied Principals of Hydrology: *Resource: Pearson Higher Ed:* http://www.pearsonhighered.com/educator/product/Applied-Principles-of-Hydrology/9780135655320.page

ii. Hydrogeology in Practice: A Guide to Characterizing Ground-Water Systems: *Resource: Pearson Higher Ed:* http://www.pearsonhighered.com/educator/product/Hydrogeology-in-Practice-A-Guide-to-Characterizing-GroundWater-Systems/9780138991548.page

iii. Water and Wastewater Technology: *Resource: Pearson Higher Ed:* http://www.pearsonhighered.com/educator/product/Water-and-Wastewater-Technology/9780135114049.page

iv. Environmental Engineering Laboratory Manual (includes 20 lab analysis tests for water and wastewater): *Resource: Kendall Hunt:* http://www.kendallhunt.com/store-product.aspx?id=18122

c. Meteorology/Climatology

i. Meteorology: *Resource: Pearson Higher Ed:* http://www.pearsonhighered.com/educator/product/Meteorology/9780132310444.page

ii. Exercises in Climatology: *Resource: Pearson Higher Ed:* http://www.pearsonhighered.com/educator/product/Exercises-in-Climatology/9780130354693.page

3) Environmental Issues: An Introduction to Sustainability (Grade 12): *Resource: Pearson Higher Ed:* http://www.pearsonhighered.com/educator/product/Environmental-Issues-An-Introduction-to-Sustainability/9780131566507.page

- **Transportation** may include, but is not limited to:

- Energy-efficient technologies or practices and renewable energy production related to transportation, mass transportation, logistics, and clean vehicle technology.
- Examples of CTE Sequence of Courses:
    - Alternative Fuels: Resource: FourEnergy, the Advanced Transportation, Technology and Energy Initiative:
        1) Introduction to Energy (Grade 9): http://www.fourenergy.org/greenacademies/html/curriculum.html
        2) Energy and Transportation Systems (Grade 10): *Resource: the Advanced Transportation, Technology and Energy Initiative, Cerritos College:* http://attecolleges.org/curriculum/energy_and_transportation_cerritos.doc
        3) Introduction to Alternative Fuels (Grades 11 and 12: *Resource: the Advanced Transportation, Technology and Energy Initiative:* http://www.fourenergy.org/greenacademies/html/curriculum.html
    - Energy Efficient Transportation Technologies
        1) Introduction to Energy (Grade 9): *Resource: FourEnergy, the Advanced Transportation, Technology and Energy Initiative:* http://www.fourenergy.org/greenacademies/html/curriculum.html (Outside Source)
            a. Or Introduction to Alternative Energy Systems: *Resource: the Advanced Transportation, Technology and Energy Initiative, Diablo Valley College:* http://fourenergy.org/curriculum/intro_alt_energy_dvc.pdf
        2) Automotive General Services Technician (Grade 10): *Resource: CTE Online:* http://www.cteonline.org/portal/default/Curriculum/Browser/CurriculumBrowser?action=2&tag=cte:model&search=&industry=7
        3) Advanced Automotive Technology Model (Grade 22): *Resource: CTE Online:* http://www.cteonline.org/portal/default/Curriculum/Browser/CurriculumBrowser?action=2&tag=cte:model&search=&industry=7
        4) Intro to Hybrid Vehicle Maintenance: Resource (Grade 12): FourEnergy, the Advanced Transportation, Technology and Energy Initiative: http://www.attecolleges.org/doc/curr/hybrid/Hybrid%20Mtc%20&%20Rpr%20course%20Sept08.doc

- **Marketing, Sales, and Service** include, but are not limited to:
    - Business development in clean technology and renewable energy that addresses: research and development; manufacturing; generation; development; maintenance; power storage; energy production; installation, repair, and maintenance of wind, photovoltaic, solar thermal, geothermal, and biomass.
    - Examples of CTE Sequence of Courses:
        1) Introduction to Energy (Grade 9): http://www.fourenergy.org/greenacademies/html/curriculum.html
        2) Introduction to Business (Grade 10): *Resource: State Center Consortium:* http://www.statecenter.com/sites/statecenter.com/files/pos/POS%20-%20Entrepreneurship.doc
        3) Entrepreneurship (Grade 11): *Resource: Pearson: Entrepreneurship: Owning Your Future:* http://www.pearsonschool.com/index.cfm?locator=PSZu7z&PMDBSUBCATEGORYID=23122&PMDBSITEID=2781&PMDBSUBSOLUTIONID=&PMDBSOLUTIONID=6724&PMDBSUBJECTAREAID=&PMDBCATEGORYID=812&PMDbProgramID=62601
        4) Renewable Energy Entrepreneurship (Grade 12): A study of renewable energy and energy efficiency technologies and issues, development of entrepreneurship opportunities and practice, and student group projects to initiate development of specific technologies and devices.
            a. *Resource: University of Colorado at Boulder:* http://ecee.colorado.edu/~ecen4000/index.html
            b. *Resource: Entrepreneurship in the Energy Sector:* http://www.techno-preneur.net/information-desk/sciencetech-magazine/2008/jan08/Entrepreneurship.pdf

Resource: Deming Center for Entrepreneurship, Sustainable Energy: http://leeds.colorado.edu/deming#overview

CHAPTER III:
Resources

Clean Energy Career Development

Senate Bill X1 1 requires that school districts propose partnership academies that focus on "employment in clean technology businesses or renewable energy businesses and provide skilled workforces for the products and services for energy or water conservation, or both, renewable energy, pollution reduction, or other technologies that improve the environment in furtherance of state environmental laws." For the purposes of this legislation, clean technology and renewable energy businesses are defined below.

- A "clean technology business" focuses on one or more of the following:
    - Energy audits for determining the energy savings that could be recovered through utility bill financing and that provide a pathway to zero net energy independent of utility bill financing.
    - Retrofitting and weatherization activities that increase energy efficiency and conservation.
    - Energy- and water-efficient public buildings.
    - Retrofitting and installing energy-efficient household appliances, windows, doors, insulation, and lighting.
    - Retrofitting and installing water and energy conservation technologies in existing homes, multifamily housing, industrial buildings, commercial and public buildings, farms, forestlands, and ranches to improve efficiency, including the use of energy and water management technologies.
    - The manufacture, sale, assembly, installation, construction, and maintenance of energy-efficient technologies and renewable energy facilities or the component parts of renewable energy technologies.
    - Energy-efficient technologies or practices and renewable energy production or the component parts of renewable energy plants and energy distribution, including energy storage, energy infrastructure (including transmission), transportation (including logistics), clean vehicle technology, clean heat and power, and water and wastewater (including water efficiency, conservation).
    - Natural resource conservation for the purpose of adapting to climate change, including fish and wildlife habitat restoration, reforestation, native species preservation, invasive species eradication, community tree planting, and

other activities that address stressors on natural resources generated by climate change.

- A renewable energy business focuses on one or more of the following:
    - Research and development, manufacturing, generation, development, or maintenance of appropriately sited power line transmission.
    - Education or promotion of renewable energy technologies.
    - Power storage.
    - Design, process engineering, installation, repair, maintenance, or related activities necessary to produce energy or fuel from wind, photovoltaic, solar thermal, geothermal, fuel cells, biomass, and biomass power.
    - Design, process engineering, installation, repair, maintenance, or related activities of energy efficiency and Zero Net Energy technologies.
    - Analysis and use of renewable feedstocks and crops to make renewable energy or fuel, including the economic linkage to food costs.

Clean Energy-Related Certifications and Credentials

The Clean Energy Partnership Academies provide the foundation for further training and programs of study. Graduates may wish to enter preapprenticeship programs, training for industry-recognized certificates, or postsecondary degree programs in related areas. This section provides examples of certifications that students can obtain either during academy study or in post-secondary programs. The list is by no means exhaustive, but it demonstrates the number and variety of certificates available in the occupations on which the academies may focus.

Clean Energy Related Certifications

Certification	Organization
Building Analyst	Building Performance Institute, Inc.
Various relevant certifications	National Center for Construction Education & Research
Air Conditioning Service Technician	North American Technician Excellence
Air Conditioning Installation Specialization	North American Technician Excellence
ASE Alternate Fuels Series	National Institute for Automotive Service Excellence
ASE Automobile Service Consultant	National Institute for Automotive Service Excellence
Autodesk Certified Associate - AutoCAD	Autodesk
Autodesk Certified Associate - AutoCAD Architecture	Autodesk
Certified Energy Auditor	Association of Energy Engineers
Certified Energy Plans Examiner	California Association of Building Energy Consultants
Certified Manufacturing Technologist	Society of Manufacturing Engineers
Certified Solidworks Associate	Solidworks
Concrete Flatwork Finisher/Technician	American Concrete Institute
Concrete Strength Testing Technician	American Concrete Institute
Corporate Sustainability Manager	Everblue Training Institute
Residential Construction Academy Series	Home Builders Institute
Electronics Systems Associate	International Society of Certified Electronics Technicians
Engineering Core Certification	Florida Engineering Society
Environmental Management Systems (ISO 14001)	ISOcampus.com
Facilities Management Certificate	Building Owners and Managers Institute
GHG Accounting and Management	Greenhouse Gas Management Institute
Green Purchasing Accredited Professional	The Green Standard
HEAT certification	HVAC Excellence
HEAT+ certification	HVAC Excellence
HERS, HERS II, Solar Homes Certified	CalCERTS
Land Use and Environmental Planning	U.C. Davis Extension
LEED AP	United States Green Building Council
National Council for Interior Design Certification	National Council for Interior Design Qualification
Photovoltaic (PV) Entry Level Certificate of Knowledge	North American Board of Certified Energy Practitioners
Precision Sheetmetal Operator - Level I	Fabricators & Manufacturers Association, International
Protective Coatings Certification	Society for Protective Coatings
Residential Accredited Appraiser	National Association of Realtors

Source: California Energy Commission

The following organizations provide additional information on apprenticeship programs and other training resources for the academies:

The National Center for Construction Education and Research develops nationally recognized, standardized curricula with portable credentials in many areas of construction. http://www.nccer.org/

The California Department of Apprenticeship Standards has extensive information on apprenticeship programs in the trades in California. http://www.dir.ca.gov/das/das.html

California Advanced Lighting Controls Technology Program instructs and certifies electricians in energy-efficient light control systems. http://www.fourenergy.org/calctp/index.html , http://www.calctp.org

Green Plumbers USA provides accredited training to plumbers in energy efficiency and water saving technologies. http://www.greenplumbersusa.com/

The U.S. Department of Energy is funding the creation of a Geothermal Heat Pump National Certification Standard to promote design and installation of reliable and high-performance geothermal heating and cooling systems. http://www.ghpncs.org/

The Interstate Renewable Energy Council has established standards for Renewable Energy, Energy Efficiency, or Distributed Generation Training Programs and Trainers . http://irecusa.org/irec-programs/ispq-training-accreditation/the-ispq-standard/

Clean Energy Occupations and Occupational Outlook

Developing program of study that connects to industry needs is essential to the success of the academy. In determining their career focus, the Clean Energy Partnership Academies should be informed by labor market information to ensure their programs reflect the reality of the labor market for energy-related occupations. There are hundreds of occupations of great variety, too numerous to include here, which academy students may pursue following graduation and are urged to explore. A number of resources for clean energy occupational information are provided below for the reference of academy instructors and students.

- The Environmental Defense Fund produced the *California Green Jobs Guidebook* to provide information on employment opportunities in the clean economy. It contains descriptions of 200 careers, the educational requirements, and corresponding wages. http://www.edf.org/climate/california-green-jobs-guidebook:
- The Donald Vial Center on Employment and the Green Economy at the University of California, Berkeley, conducted the *Workforce, Education & Training Needs Assessment for Energy Efficiency, Distributed Generation, and Demand Response.* The study examines the opportunities in California for future employment that addresses these issues. http://www.irle.berkeley.edu/vial/
- The Employment Development Department has a wealth of labor market and employment information on the general economy and on the green economy as well as occupational profiles. http://www.edd.ca.gov/, http://www.labormarketinfo.edd.ca.gov/?pageid=1032
- Next 10 has conducted numerous studies on the green economy in California. http://next10.org/index.html

- The California Green Jobs Council is convened by the California Workforce Investment Board and is tasked with creating a coordinated, statewide plan for creating green jobs. http://www.labormarketinfo.edd.ca.gov/article.asp?articleid=1243

- The Corps Network has published *The Green Pathways Framework*, which contains The http://www.cows.org/pdf/rp-GreenCareerPathFramework.pdf

- The Brookings Institute conducted a study on the clean economy and green jobs assessment: http://www.brookings.edu/reports/2011/0713_clean_economy.aspx

- The California Community Colleges Centers of Excellence conduct regional economic and workforce research relevant to community college programs. http://www.coeccc.net/

- The U.S. Environmental Protection Agency has created a website on clean energy jobs with descriptions, data, and resources: http://www.epa.gov/statelocalclimate/local/topics/workforce.html, http://www.epa.gov/osem/greeneconomy.htm

    - The U.S. Department of Energy has drafted *Workforce Guidelines for Home Energy Upgrades*. This document focuses on promoting quality, certified training for energy efficiency jobs. http://www1.eere.energy.gov/wip/retrofit_guidelines.html

- Green for All is a nonprofit organization dedicated to building the green economy and sustaining an infrastructure that closes the gaps in income, wealth, health, security and opportunity. http://www.greenforall.org/

Examples of Partnership Academies Focused on Clean Energy

Several academies funded under the 2009 California Partnership Academies Green/Clean Initiative and other partnership academy funding focus on clean energy and serve as potential models for the Clean Energy Partnership Academies because of their unique operations, facilities, or partnerships that improve their students' chances of success following graduation. Profiles of three of these academies appear below.

Venture Academy Charter School, Stockton

Venture Academy is a charter school operated by the San Joaquin County Office of Education in Stockton and is one of five New Energy Academies sponsored by Pacific Gas and Electric Company. The other four are in Sacramento, Berkeley, Fresno, and Bakersfield. All five academies were launched in the fall of 2010.

These academies are designed to prepare students equally well for post-secondary education and for entry into careers in energy and construction. The curriculum blends traditional academic subjects with emphases on math, physics, and electronics with courses that lead to industry certifications in safety, hand and power tool use, reading construction drawings, and other workplace skills. The academies have the latitude to customize instruction according to local needs and to integrate with the school's existing academic programs.

Classroom kits and curriculum are provided by the National Energy Education Development (NEED) Project, LJCreate, and KidWind. Trade certification instruction is provided by the National Center for Construction Education and Research (NCCER). Because Venture's New Energy Academy is one of several Career Technical Education programs offered by the district, students also have access to classes in construction, welding and metal arts, robotics, and computer aided drafting and computer-aided manufacturing (CAD-CAM) and videography. Students have one independent study day per week to access these facilities for energy-related projects and to apply what they learned in the classroom. For example, a rapid prototyping machine and laser-cutting equipment allow students to build models based on their ideas, including models of passive solar homes or wind turbine blades.

This year students will begin work on converting a donated 1978 MG Midget automobile to all-electric power. They are also planning to build a hydrogen-powered light-weight racer. In addition to PG&E's support, the academies have the support of the Greater Stockton Chamber of Commerce and several local and national sponsors that provide material, financial, and advisory support, including KidWind, Jaguar Heaven, and Horizon Fuel Cell Technologies.

The Venture New Energy Academy will also be able to learn from a planned 500 kilowatt solar photovoltaic shaded parking installation with electric charging stations. A Qualified Zone Academy Bond (QZAB) was approved for this project, which will allow students to use this on-site renewable energy production facility as a learning lab. Students will be involved in activities and research related to the construction, operation, maintenance, and electrical production of their solar power system.

Green Energy Technology Academy, Laguna Creek High School, Elk Grove

The Green Energy Technology Academy (GETA) studies the technology used in energy conversions, with an emphasis on clean and green energy. Through rigorous hands-on, project-based assignments, nationally certified curriculum, mentors, field trips, and guest speakers, GETA students learn in an environment that prepares them for postsecondary transitions to colleges and universities, trade schools, or direct employment in the energy and utilities sector. Students learn about solar and wind energy, biofuels, and electric transportation and apply this knowledge directly in project-based activities. For example, students assemble solar-powered battery cases, which they send to medical clinics in developing nations.

The National Center for Construction Education and Research (NCCER) provides the curriculum for the career technical education classes. Instruction is arranged in modules taking from two to eight weeks to complete. Students may take an exam on completion of a module, or they may complete a hands-on component to receive a certification. The modules include safety, hand and power tools, construction drawings, communications and employability skills, Electrical Level I, introduction to the power industry, and introduction to solar photovoltaics. The career technical education courses are supported with academic core classes in science, social science, and English.

This academy was one of the first of its kind in the country and regularly hosts visitors from other schools interested in starting a similar program and from other countries interested in partnering on clean and green energy projects. The academy recently hosted visitors from Liberia, Ghana, and Kenya. The students are currently working on a greenhouse project, which will be entered into the MIT IDEAS competition that encourages teams to develop and implement projects that make a positive change in the world. The students' project will benefit people that live on less than $2 per day.

New Energy Career Academy at Independence High School, Bakersfield

Students in the New Energy Career Academy are in a unique program developed by Pacific Gas and Electric Company (PG&E) in partnership with CDE. Through this partnership, the students are learning the knowledge and skills used in the real world. The students at this academy attend regular academic classes that are integrated with career technical education courses focused on careers in energy and the environment. For example, instead of simply studying Ohm's Law in a physics class, they apply this principle to energy conservation as well as a detailed analysis of their electrical use and the related costs. Students learn about the practical applications of energy through field trips and guest speakers that demonstrate wind and solar energy, oil and gas drilling, and how to capture methane gas from food waste, for example. The regular curriculum comes alive through guest speakers and field trips focused on energy and utilities. Teachers also have an "externship" where they visit an energy or utility company so they can bring real-world examples back into their classroom.
The academy is also distinctive in several ways. It has a dedicated counselor for the students, as well as an advisory board that provides input on the curriculum. Besides PG&E, the advisory board includes the Chamber of Commerce and the Kern Economic Development Corporation. The academy also articulates classes with nearby Bakersfield Community College so students can earn college credit before graduation.

Effective Date of Guidelines

The Guidelines were adopted by the **Energy Commission at a publicly** noticed meeting on XXXX, and are posted on the Energy Commission website at:

http://www.energy.ca.gov/cleanenergyacademies.html

Appendix I – Senate Bill X1 1

http://www.leginfo.ca.gov/pub/11-12/bill/sen/sb_0001-0050/sbx1_1_bill_20110418_chaptered.html